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# ANNUAL REPORT

LAKE STATES FOREST EXPERIMENT STATION  
FOREST SERVICE  
U.S. DEPARTMENT OF AGRICULTURE

E.L. DEMMON, DIRECTOR

1945

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EXPERIMENT STATION

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UNIVERSITY OF MINNESOTA  
UNIVERSITY FARM, ST. PAUL 8, MINNESOTA

## Lake States Forest Experiment Station

### ANNUAL REPORT FOR 1945

#### GENERAL

Critical years for forestry in the Lake States lie ahead. Caught between a peak demand for products of the forest and a timber resource seriously run down by war-time production, a constructive forestry program must be put into effect promptly if the Lake States forests and forest industries are to contribute more fully to peacetime reconversion and employment. Forest research, which provides an essential step towards better forestry, can play an important role in shaping such a program and keeping it moving most effectively.

The 50 million acres of commercial forests in the Lake States helped enormously in providing raw materials vital to the war effort. At the dawn of a new peace the highlights of the forest situation in this region are these:

1. Demand for forest products is greater than ever before - lumber for homes and farm buildings; wood and veneer for furniture; pulp for paper, cartons, and molded products; poles for power lines; and ties for railroad extension and renewal.
2. Never has there been more concern for developing new industries and for keeping established industries operating to provide jobs and consumers' goods.
3. The pent-up demand for the recreational use of the forests has never been greater.
4. The annual saw-timber drain from cutting (much of it in immature stands) and natural losses during the past 10 years has averaged about 1.8 billion board feet, exceeding annual growth by more than 25 percent. During the same 10-year period merchantable saw-timber volumes have declined about 9 percent.
5. Local forest industries, geared to extraordinarily high war-time demands, with their accessible high-grade timber supplies dwindling, with equipment run down, and normal marketing channels disrupted, must adjust themselves to smaller and poorer timber, more difficult operating conditions, and a highly competitive market.
6. Public programs of forest reconstruction - land acquisition and consolidation, forest planting, stand betterment, road building, etc. - were largely disrupted and progress in forestry education and farm forestry seriously retarded by the war.

For all these reasons this is an opportune time to reappraise the forestry situation in the Lake States and determine how research can (a) aid forest landowners with information as to improved techniques in reforestation, protection, and management of timber stands, (b) show how to make better use of inferior timber and improve efficiency of operations, and (c) assist the States and local governments in the development of sound land-use plans, including the consolidation of forest land ownership.

The Lake States Forest Experiment Station, established in 1923, carries the federal government's share of forestry investigations in this region, in cooperation with State and other local agencies. Within the limits of funds available, the Station has (1) made surveys of the quantity of standing timber in different localities, determined current and prospective growth rate and the amounts of timber cut and lost through natural causes, and estimated the demand for forest products; (2) cooperated with other agencies in the compilation and analysis of the costs of growing, logging, milling and transporting forest products, in appraising forest land values, in analyzing the financial aspects of forest management, and in studying trends in the ownership, use, and taxation of forest land; (3) cooperated with the national forests and state conservation departments in developing better methods for preventing, detecting, and suppressing forest fires; (4) worked with administrators of state and federal forests and with state educational institutions in developing improved methods of reforestation, devising systems of cutting to provide higher yields and more adequate regeneration of the forest, discovering methods of improving the quality of good aspen stands and converting poor aspen to more valuable pine and spruce forests, measuring the effect of forest cover on runoff and soil erosion and determining the value of windbreaks and shelterbelts in the northern Great Plains; (5) cooperated with the Fish and Wildlife Service in studying effects of certain animals on forests, means of preventing damage, and the biological problems involved in multipurpose forest management, such as the seasonal food requirements of different game birds and mammals.

While progress has been made, many problems in several major forest types have not yet been touched. To carry on studies most effectively and to make them of most value to local industries and landowners, the Station has proposed setting up a series of research work centers in sections of the Lake States which have distinct forestry problems. Also, a forest utilization service proposed for the post-war period would determine how best to utilize our present forest resources, including analysis of waste in logging, milling and re-manufacturing and the investigation of better integration of uses; bring the problems of forest industries to the attention of specialists at the Forest Products Laboratory and elsewhere; stimulate pilot-plant operations on new products or manufacturing methods; and investigate the possibilities of increasing forest yields by utilizing thinnings and improvement cuttings and material not now merchantable.

The annual report briefly reviews the work of the Station for 1945.

## FOREST ECONOMICS

### Forest Survey

During 1934, 1935, and 1936 the Lake States Forest Experiment Station conducted a field survey of the forest resources of this region. In 1945, approximately 10 years later, these forest statistics were brought up to date by making deductions for the timber which had been cut or depleted due to various causes during the 10-year period and additions for the growth estimated to have accrued.

No significant differences in total forest area were found. For Minnesota, Wisconsin and Michigan this area is 55.7 million acres, or approximately 45 percent of the total land area. There are 6.5 million acres of commercial saw timber, 9.5 million acres of commercial timber of pulpwood or pole size, 20.5 million acres covered with seedlings and saplings, and about 19 million acres of poorly stocked, denuded, or non-commercial areas.

The commercial forest area of 50.3 million acres is in the following ownerships: 13 percent federal, principally national forests; 15 percent state; 14 percent counties and municipalities; 58 percent about equally divided between farmers and other private owners.

During the 10-year period the volume of merchantable saw timber dropped from 57.6 billion board feet to 50.7 billion board feet. The current annual growth of saw timber decreased from 1.75 billion board feet in 1936 to 1.4 billion board feet in 1945. In spite of heavy cutting during the war, the average annual drain during 1945 was only 1.8 billion board feet. This would have been greater had it not been for the relatively favorable record of losses from fire, insects, and disease during the last 10 years. Cutting for fuelwood also was considerably reduced during this period. The relationship of growth to drain is even more unfavorable than the figures indicate since growth is scattered thinly over large areas and on many small trees just coming into sawlog size, much of it aspen, while the drain is mostly from the larger-sized, more valuable timber stands.

This reappraisal indicates that the forest growing stock in the Lake States is on the decline, particularly in the valuable spruce and northern hardwood forests. It foreshadows a drop in the number of lumber mills with commensurate reduction in employment, payrolls, and tax base unless, of course, adjustments are made within the industry.

The reappraisal also brings out the fact that in spite of heavy cutting during the war, there are vast quantities of aspen and other secondary species suitable for box lumber, pulpwood, and various other products, which are not being utilized fully. It also indicates the unavailability of some of the volume of valuable jack pine, balsam fir, and hemlock, which is in relatively inaccessible areas or has been reserved from cutting.

Study of growth potentialities show the vast gap which exists between the yields from extensive, poorly-managed forest areas and those which can be obtained on selected tracts given the best possible treatment. It suggests that the forest lands of the region are producing less than one-half of what they could yield under fairly good management.



## Requirements and Supplies

The main activities of this project in 1945 have continued to be a monthly survey of lumber and tie production and stocks, a periodic report on factors affecting lumber production, and other reports of a special nature. In addition to these activities the field men have been called upon for a variety of special surveys for W.P.B. and other war agencies.

Highlights of this project in 1945 are listed below:

1. A monthly forest products news letter was sent to some 1,200 cooperators to disseminate information of importance and interest to the forest industries. These letters contained information on new or revised regulations affecting forest industries, localized cost data on logging and milling, stumpage prices, etc., logging and milling safety hints, and monthly lumber production figures by mill class for each district and state.

Another service included the circulation of current lists of used equipment for sale, in close cooperation with the Timber Production War Project.

2. That Lake States fuelwood production in 1945 was considerably short of requirements was indicated by an extensive survey. Survey results are shown in the following table:

1945 Fuelwood Estimates

State	: Requirements:	: Estimated production
<u>Thousands of standard cords</u>		
Minnesota	2,000	1,525
Wisconsin	2,138	1,812
Michigan	1,500	985
Region	5,638	4,322

Labor, transportation, prices, and lack of interest were factors responsible. Suggestions to avert fuelwood shortages were: (1) More widespread use of North Dakota lignite; (2) local cutting bees, including pooling of available labor and equipment for fuelwood production under local promotional management; (3) more publicity through newspapers, bulletins, and radio on the need for fuelwood.

3. Employment estimates for forest industries were made as shown in the following table. Figures in the table do not include workers employed in plants not connected with sawmills, in independent planing mills, or in secondary wood-using plants such as sash and door factories, toy plants, etc.

# Lake States Employment Estimates - July 1944

Industry	Woods	Mill 1/	Total
<u>Number of men</u>			
Sawmills	4,230	10,580	14,810
Veneer and plywood	380	4,430	4,810
Cooperage	10	180	190
Shingle mills	20	220	240
Chemical plants	420	280	700
Excelsior plants	250	270	520
Box mills	240	500	740
Logging camps	2,650	...	2,650
Pulpwood camps	6,730	...	6,790
Other camps	870	...	870
Conversion plants	10	170	180
All industries	15,870	16,630	32,500

1/ Includes workers in mills, secondary processing, yard shipping, etc.

4. Cross tie production in the Lake States exceeded 4 million pieces in 1944 produced in some 700 Lake States tie mills according to a survey made by the Station. Of the 4,120,000 ties, 46 percent were produced in Wisconsin, 32 percent in Michigan, and 22 percent were produced in Minnesota.

By grades, the ties produced in the Lake States in 1944 were 11 percent No. 5, 21 percent No. 4, 34 percent No. 2, 14 percent No. 1, and 6 percent serviceable rejects. Further details are given in the table below.

Although the 1944 cross tie production was higher than in 1943, observations indicate that 1945 production was considerably less than in 1944.

## Lake States Tie Production by Species - 1944

Species	No. of ties	Percent of total
<u>Thousands</u>		
Oak	1,255	30.5
Maple	895	21.7
Birch	564	13.7
Aspen	430	10.4
Elm	180	4.4
Ash	132	3.2
Other	51	1.2
Total hardwoods	3,507	85.1
Cedar	338	8.2
Hemlock	144	3.5
Other	131	3.2
Total softwoods	613	14.9
All species	4,120	100.0

5. Cedar pole production in the Lake States, according to Station estimates, was roughly 230,000 in 1943, about 90,000 in 1944, and about 45,000 in 1945. About half of the 1944 production was in Minnesota and most of the remainder in northern Michigan.

With the rapid depletion of cedar supplies in this region, poles 30 feet and longer are very difficult to obtain. However, shortages exist in all sizes. Approximately 75 percent of the poles now cut in this region are 25 feet or less in length.

#### Markets for Aspen Needed

Although there has been a rapid rise in the use of aspen for lumber, box material, and pulpwood in the Lake States during the past several years, it is estimated that the current rate of depletion is less than half the current growth rate. Large quantities are rotting on the stump.

Preliminary surveys indicate that aspen timber can be profitably marketed in large volume if certain prejudices and misconceptions can be overcome and methods of handling are improved.

Michigan furniture manufacturers, for example, have a very good market for their product, but have lost many of their former sources of lumber. The need for core stock is particularly critical. A few fabricators used aspen as core material during the war years and were well satisfied. Several furniture manufacturers are now ready to try aspen for interior frame stock.

Manufacturers of venetian blinds and juvenile furniture have been experimenting with aspen with satisfactory results.

Because of the well-known suitability of aspen for boxes and other containers, such use has increased markedly during the war.

The market for aspen pulpwood also has increased tremendously, and there is every indication that this use will expand still further.

Although the volume of aspen timber is large, the quantity of large, high grade material is somewhat limited. Full utilization will therefore involve processing large quantities of small and somewhat defective timber. This introduces new economic problems which research agencies can help solve. The Lake States Station is proposing to contribute toward their solution by taking stock of the quantities of aspen tributary to certain major wood consuming centers and classifying the material as to size, quality, and general availability. The Station proposes also to study the cost of logging, transporting, and cutting various grades of aspen and to develop cost saving procedures. Thirdly, the Station proposes to continue market surveys and examine the possibilities of utilizing by-products of some industries to supply raw materials for others.

#### Economic Aspects of Farm Forest Management

On several woodlots in Southwestern Wisconsin cut over during the winter of 1944-45, the Lake States Station collected information showing conclusively the advantage of holding oak timber until it reaches a fair size before cutting.



At 40 years of age one such hardwood tract had a merchantable volume of 1,800 board feet per acre, but because of the comparatively low market value for small logs - about \$25 per M, and relatively high logging cost in such timber, the trees had virtually no net stumpage value.

Twenty years later, the same tract would have a merchantable volume of 8,500 board feet per acre including 3,150 of high grade logs worth \$60 per M at current values. The timber would be worth about \$99 per acre on the stump. In other words, for the first 40 years no net timber value had accrued whereas during the following 20 years the annual increase would be nearly \$5 per acre.

At the age of 80 years, the tract would have an average volume of 15,000 board feet per acre worth \$264 at present values, indicating an estimated average annual gain of more than \$8 per acre per year for this last 20-year period.

#### Availability of Lake States Pines for Poles Explored

Because of the heavy demand for telephone and power poles developing after the war, and the high freight on southern and western pole timber to the Lake States, pole suppliers in this area are showing much interest in the use of jack pine and red pine.

Rough calculations indicate that there are about 5-1/2 million pine trees of pole quality in the Lake States and that an annual production of several hundred thousand could be sustained if this use represents a priority higher than for pulpwood or other needs.

The Station collaborated with the Forest Products Laboratory and the American Standards Association in developing emergency specifications to put Lake States pines on an even footing with lodgepole - their nearest competitor.

The Station now contemplates a survey of the available supply of pine poles and is collecting information on production costs and other factors related to marketing problems.

### FOREST MANAGEMENT

#### Forest Fire Research

During 1945, attention has been centered primarily on the economic aspects of fire control. Data were compiled on area in need of protection, allowable burn, cost of adequate protection, and the economic limits of protection expenditures. In addition, an analysis was made of the results of fire control in the Lake States during the past 15 years, and a study of fire occurrence by states was undertaken. Also, the Lake States fire danger meter was redesigned and an inspection made of fire danger stations in Michigan and Wisconsin.

Of outstanding interest is the progress made in fire control during the last 15 years, as shown by the analysis of fire control records. This is attested by an over-all reduction of 67 percent in the number of fires, 92 percent in area burned, 77 percent in the size of the average fire, and 90 percent in annual loss, on the basis of 5-year averages. Although some 2,800 fires still burn 65,000 acres annually, the risk of burning has been reduced from 1.74 to 0.13 percent of the area protected. Favorable weather conditions have contributed to this, but most of the improvement can be ascribed to better financed and more



effective fire prevention and control. During the period in question pre-suppression expenditures have increased 63 percent, but suppression costs have gone down 80 percent, and the over-all cost-plus-loss, 40 percent. Each of the three Lake States has made an excellent record, but Minnesota is still handicapped by inadequate appropriations in worse than average years. Wisconsin has made the most progress and is doing the most effective job. Michigan is also getting excellent results but is spending more money than the others.

Application of the economic principle of minimum cost-plus-loss to available fire control data indicates that an average annual expenditure of 3.75 cents per acre is needed; in an average bad year this would increase to 4.5 cents. A mean annual burn of 0.2 percent would cost on the average about 4.4 cents per acre per year.

The above figures are based on current estimates of direct damage. Although higher estimates of loss would justify somewhat higher expenditures, the increase is at a rapidly diminishing rate. The extent to which increased expenditures can be justified by higher damage estimates, therefore, is limited. From a practical standpoint, area burned is a good criterion of the effectiveness of protection and there is little justification for spending more than is necessary to maintain the mean annual burn at an acceptable level. A mean annual burn of 0.3 percent can be economically justified in the Lake States region. This figure has already been more than attained with an average annual presuppression expenditure of 3.1 cents per acre. Further increase in expenditures therefore call for careful consideration.

From the standpoint of administration, an organization based on average needs would obviously be inadequate in worse than average years (about one in three). More properly, it represents the minimum organization needed. Anything over this amount, however, must be considered as a margin of safety against worse than average conditions. The margin required is a matter of judgment and experience, but an organization based on the average bad year would seem to be reasonable and generally adequate.

It is obviously impractical to maintain at all times the protection organization called for by peak conditions. It is necessary, therefore, to know when peak loads are most likely to occur and their probable intensity. Present plans contemplate completing the study of fire occurrence and of allowable cost and burn. Also, there is need for the compilation and analysis of accumulated fire weather data as a basis for rating and comparing seasons, determining fire danger, and judging accomplishment. A comprehensive fire analysis should be available for each state to provide the basis for intelligent protection planning.

Other important research projects planned involve hazard or forest fire fuels as a basis of revising and reclassifying fuel types, including a study of rate of spread and resistance to control to supplement the meager information now available; a revision of the fuel type maps now in use; and an overhauling of the present fuel type classification, moreover, before the maps are revised.

### Pine Management

The pine forests of the Lake States cover nearly 4-1/2 million acres and are extremely important to the maintenance of forest industries in this region. Of the three common pine types (white, red, and jack pine), jack pine covers much the larger area.

## Jack Pine

Pulpwood is the chief present use for jack pine, more than half of the cut being utilized for this purpose. It has been demonstrated that on the better sites jack pine is capable of producing more valuable products such as mine timbers, sawlogs, poles, and piling, if stand productivity is not impaired by premature cutting for pulpwood. With good markets for pulpwood the urge is to harvest as soon as the trees reach minimum merchantable size.

That such premature cutting is unnecessary has been brought out by thinning studies of the Station. These show, for example, that it may be possible to increase pulpwood yields by as much as 20 to 25 cords per acre during the first 50 years of a stand's life, by means of frequent thinnings. Even discounting these figures by half it would be possible, with periodic thinnings, to produce from 350,000 to 400,000 cords of jack pine and red pine pulpwood annually - more than the pre-war cut of this species in the Lake States. A rational thinning policy, if widely practiced, would thus supply large quantities of pulpwood without destroying the productivity of the forest capital.

## Red Pine

The experience of many years of research and management of red pine is being assembled in manuscript form. First attempts at management were by the seed-tree method. A large-scale test begun in 1904 showed, 20 years later, that on the average more than two-thirds of the reproduction had become established before cutting. Thus the seed trees had less effect than advance reproduction in restocking areas to red pine.

Two-cut shelterwood cuttings have been more successful than the seed tree method, although less extensively applied. Under this method the stand is removed in two cuts spaced by a sufficient interval to permit seeding-in of a new crop under the protection of a partial stand. Use of such a method represents reasonably good forestry practice but by no means gets the most out of a stand.

More intensive management is now possible in most places.

Recommendations for intensive management call for:

1. Thinnings in pole stands for pulpwood beginning at about 35 to 40 years or sooner, if markets develop for smaller material, such as fence posts.
2. Thinnings in middle-aged stands, from 50 to 70 years old, for box bolts, poles, and mine timbers.
3. Thinnings in stands upwards of 80 years old, for piling, mine timbers, and sawlogs.
4. Harvest cuttings by the shelterwood or group-shelterwood method, with the removal of the stand in three or four cuttings - the final removal cut coming at about 140 years of age.



## White Pine

White pine, the main-stay of the lumber industry during the boom logging days, and at present almost depleted in saw timber stands, shows some signs of coming back. Surveys made by Blister Rust control crews indicate much new reproduction seeding-in during the past few years. Also, some second-growth stands, especially in Wisconsin, are developing into merchantable forests, and the Station is being asked how best to manage and perpetuate this species. There is a clear-cut need for forest management research in this valuable forest type. Any research undertaken should be done in close cooperation with Blister Rust control agencies because of the threat that the blister rust disease offers unless suitable control measures are taken. Studies will be initiated as soon as funds are made available for this purpose.

### Reproducing Yellow Birch by the Group Selection Method

Considerable concern has been expressed because yellow birch does not reproduce naturally following selective cutting as ordinarily practiced. This is important because yellow birch makes up 10 to 15 percent or more of the northern hardwood forest and is the most valuable species in the stand, commanding prices as high as \$114 per M for veneer logs - the present ceiling price.

Selective cutting has many advantages and its practice insures a steady flow of quality material. However, it was anticipated as early as 1929 that such practice might not be suited to the natural regeneration of yellow birch. Consequently special cutting experiments were designed at the Upper Peninsula Experimental Forest with the specific objective of reproducing birch. Those experiments now show that yellow birch will start naturally if small openings up to one-tenth acre in size are created within seeding distance of seed trees. Birch regeneration in such openings now makes up 18 percent of the total stand of reproduction, and exceeds the proportion of birch in mature stands in the vicinity. This reproduction ranges up to 20 feet in height and gives every promise of maintaining itself in the coming forest. By supplementing light improvement cutting with the group-selection method the main advantages of both methods can be retained and at the same time yellow birch can be reproduced.

### Improving Cull Determination in Northern Hardwoods

Northern hardwoods which have a value of \$50 to \$300 per acre on the stump and from \$30 to \$114 per M feet B.M. for logs f.o.b. railroad cars are very difficult to appraise because of defect and rot. This defect ranges from 0 to 100 percent in individual trees and even the best appraisors often err in their estimates of soundness - sometimes by as much as 50 percent. This difficulty of getting good estimates causes considerable trouble in the sale of timber and in the planning and conduct of logging operations.

Through a scientific approach the Station has developed a method of appraising cull in northern hardwoods which has consistently given good results. After a study of many hundreds of trees on numerous logging operations it was found that practically every internal defect has some external evidence or "symptom." A cull factor was then established for each visible mark of such cull or defect. Application of these factors in a number of fairly exhaustive tests indicate that cull can be consistently estimated to within 10 percent and often as closely as 2 or 3 percent accuracy. To give reliable results it is not necessary to apply the method to every tree tallied in a timber cruise but only to a representative sample.



Extension of these principles to other species may greatly improve the precision of timber estimates in general.

### Managing Northern Swamp Forests

Black spruce continues to be the Lake States' most valuable pulpwood species. Slash disposal experiments established on the Superior National Forest in black spruce swamps in 1938 have brought out some interesting points. Where slash has been piled there were 5,520 seedlings of pulpwood species per acre seven years after cutting and they occupied 95 percent of the area. On the other hand, where slash had been lopped and scattered there were only 3,200 such seedlings per acre distributed over only 75 percent of the area. Where the slash had not been treated there were 3,900 seedlings per acre, or slightly better than where it was lopped and scattered. Piling and burning was somewhat less effective than piling alone in promoting reproduction (4,900 per acre). From these tests it appears that lopping and scattering slash gives poorer results than no disposal. Further tests are needed elsewhere to determine applicability of this information generally.

A comprehensive manuscript incorporating the results of past research of the Station on black spruce was completed during 1945. It is planned to publish this as a government circular.

In the future, forest management studies should be initiated for tamarack and northern white cedar. Tamarack seeded in abundantly after the old stands were virtually wiped out by insects about 30 to 35 years ago. These young stands are now approaching merchantable size for pulpwood. Northern white cedar makes excellent poles, but the stands have been seriously depleted. Tamarack together with cedar comprise over three million acres of productive forest land in the region. Guides are needed for their intelligent management.

### Aspen Management

With expanded markets for aspen pulpwood and other products the term "weed tree" as applied to this species has become obsolete. Aspen of fair quality in reasonably accessible localities is now finding a market. Aspen as a regular crop tree should be considered along with pine, spruce, and hardwoods as worthy of some care and attention - at least on the better sites.

The cutting practice recommended in the past for aspen has been clear cutting. Observations indicate that this species reproduces well if the area is actually cut clear and if too many cull trees are not left to interfere with the new growth. The most common and dependable form of aspen reproduction is the root sucker. Suckers usually spring up readily on areas logged in the fall and winter months, when logging has been commonly done in the past. Obtaining natural reproduction of aspen did not seem to pose any problem.

With the war came an increased demand for peeled aspen pulpwood, and this can be produced most economically during the spring and early summer "stripping" season. It is now found that summer-logged areas are not reproducing satisfactorily. They do not put out many suckers until the following spring and these are fewer and weaker than ones from winter logged tracts. Moreover, brush gets a head start on summer-logged areas, making tough competition for the new aspen suckers.

Since summer logging will probably continue and may even increase, we are faced with the problem of how to manage poorly reproduced cut over aspen areas to get them back into production. In an attempt to answer this question the Athens disk plow was tried out on a tract logged three years previously. After spring disking the area sprouted vigorously with 5,300 clumps (14,630 stems) per acre compared to 750 sprout clumps on untreated areas. Disking seems to offer promise.

### Planting and Nursery Studies

With the conclusion of the war preparation of reports covering past nursery and planting investigations has been resumed. A draft of a manuscript on planting has been completed in cooperation with the Northeastern Station to be released as a Farmers' Bulletin. A comprehensive report on reforestation in the Lake States is now approaching completion. The preparation of a forest nursery practice manual applicable to Lake States conditions has been started up again after a lapse of several years. There is an increasing demand for the results of past research in reforestation to be used in planning and carrying out post-war projects on tree planting.

### Survey of Shelterbelts in Great Plains

To provide a sound basis for post-war tree planting in the Plains region, a survey was made in 1944 of the shelterbelt plantings begun 10 years previously, and a report was prepared in 1945.

That the plantings were highly successful was clearly brought out in the survey. Out of 1,079 belts examined, 90 percent were in satisfactory condition. Kansas lead all the other states with 95 percent satisfactory.

Belts averaging 9 years old were found to average 16 feet high in North Dakota, 20 feet in Nebraska, and 24 feet in Texas. Average height growth per year for typical species were as follows: Cottonwood, 2.9 feet; black locust and Chinese elm, 2.3 feet; green ash, 1.3 feet; average of all shrubs was 1.1 feet; Rocky Mountain red cedar, 0.7 feet; and ponderosa pine, 0.6 feet.

The most rapid growth rate was observed in a 7-year-old Texas shelterbelt with cottonwood 50 feet high and 10 to 12 inches in diameter.

Experimental plantings made in 1936 by the Station in Oklahoma showed considerable promise in the use of narrow 1- to 3-row belts; single row belts involving tree by tree alternation in the row, using cottonwood and mulberry, were highly successful, and introduce a new concept of shelterbelt planting.

The chief problems in the belts were presence of livestock in 8 percent of all belts, and lack of adequate cultivation. The latter was aggravated by shortage of labor because of the War.

In general, the belts are highly successful and have proved tremendous assets in improving the landscape, providing highway snowtraps and a haven for game and song birds, checking wind erosion, and protecting farmstead, gardens, orchards, and feed lots.



## COOPERATIVE FARM FORESTRY

### Wisconsin (In cooperation with Wisconsin Agricultural Experiment Station)

The War taught many farmers in southwestern Wisconsin that, far from being an economic drag, their farmwoods were a source of real profit. It is hoped that this lesson will not be forgotten in the post-war period. The present forest cover, amounting to about 30 percent of the total area in farms, is confined largely to slopes steeper than 15 percent. There is no conflict with cropping on these rugged sites; but to some extent there is a conflict with pasturing. The various aspects of this latter problem have been studied at Richland Center during the past five years.

### Pasture Experiments (Conducted by Wisconsin Agricultural Experiment Station)

Records now are complete for 12 renovated pastures and eight checks comprising 48 and 36 pasture-year's data, respectively. The improved sweet clover-red clover-blue grass mixtures have outyielded the blue grass checks by ratio of 2.2 to 1.0 (3,210 pounds dry-weight per acre as compared to 1,453 pounds). In addition, during the five-year period there were approximately only one-fourth to one-fifth as many weeds and two-fifths to two-thirds as many white grubs in the renovated pastures as in the untreated pastures. Woods' pastures (sparsely-timbered areas) continue to fall far behind (276 pounds, dry-weight, per acre) open lands in productivity. Studies made of the susceptibility of sweet clover to disease, completed in 1944, lead to the establishment of alfalfa-brome grass seedings. The 1945 yields from these areas showed great promise on an observational basis, and seem to indicate the value of this forage combination in future pasture improvement. Agronomic experiments were confined to north-and south-facing slopes having gradients of 15 to 35 percent. This phase of the project was completed in 1945.

### Woodland Studies

No new forest research investigations were initiated at Richland Center during 1945. Since it is the plan to reorient the project with completion of the agronomic phase, and to broaden the forestry investigations, it seemed best to summarize all data obtained during the first five years and publish the important findings. The main forestry contribution will be the oak-yield study report, which is now in rough draft form. The matter of a joint Forestry-Agronomic report will be held in abeyance until all technical reports are completed.

The plan is to broaden the farm forest research program by conducting studies of cultural and harvest cuttings and reforestation on typical farmwoods areas now being acquired by the State Conservation Department in southern Wisconsin. One obstacle to such research in the past was the lack of suitable tracts where long-time ownership and control was assured. The Station will supervise the silvicultural work.

The University of Wisconsin will continue studies of grazing damage - particularly of the influence on soil, and will undertake studies of pathology and of wild-life influences related to forest management. The Conservation Department will furnish the areas on which to work and cooperate in other tangible ways, if adequate federal or other funds can be provided.



Minnesota (In cooperation with Minnesota Agricultural Experiment Station)

The study of the utilization of aspen lumber for farm building construction has been concluded and the results written up. As a part of the study some 66 M ft. B.M. of aspen lumber was graded with the following results:

	<u>Percent</u>
A-finish.....	1.8
B-finish.....	2.7
No. 1 construction boards.....	13.2
No. 2.....	31.9
No. 3.. ..	44.7
Below grade.....	5.7
	<u>100.0</u>

It is apparent that the proportion of high grade material is not large. On the other hand, it should be pointed out that the lumber in this grading test was being manufactured for boxes and no attempt was made to saw for grade. The proportion of higher grades could, no doubt, be increased with attention to grade sawing. It is hoped that the results of this work can be published shortly since the need for construction lumber is urgent and aspen lumber can fill a part of the local need.

Work is being started on a study which has for its purpose the development of a satisfactory method for small-scale preservative treatment of fence posts suitable for use by farmers. The first phase of this study will be to compile all existing information that applies to the treating problem - the second to study costs of knife peeling vs. strip peeling and costs of producing and marketing treated posts. Supervision of the wood preservative phase will be by the University and other phases by the Station.

Michigan (In cooperation with Michigan Agricultural Experiment Station)

Emphasis on the cooperative farm forestry project in Michigan is being given to the mechanical improvement of small sawmills. Such improvement will lead to better manufacturing of lumber from farm woods, and ultimately to more profitable returns to these owners of small timber tracts.

A new scale or index board to assist the sawyer in cutting boards to desired dimensions and to eliminate waste has already been developed. This will result in more accurate sawing and more versatility in the use of existing equipment. It is relatively simple and economical to construct and will undergo thorough test during the year.

Future work contemplates the development of low-priced air dogs to replace hand-operated dogs ordinarily used by small mills to hold logs in place for sawing. It is believed that through holding logs on the carriage more securely better lumber will result.

Other improvements needing development are: (1) automatic rack and pinion adjusters, (2) saw lead indicators and improved lead adjusting equipment, and (3) adaptation of beam lights for slab and edging cut indicators.

The technical phases of this project are under the supervision of Michigan State College.

## FOREST WILDLIFE RESEARCH

(Conducted by Fish and Wildlife Service in Cooperation with the Forest Service)

Wildlife research on forest land has been curtailed during the war period because of lack of funds and personnel. The biologists assigned to the Station have had to devote much time to such projects as the raising of domestic rabbits for food, management of muskrats, etc., besides dividing their time between work on Indian lands, national parks and national forests. In addition to this they have been assigned to other high priority projects such as problems on Wildlife Refuges and appraisals of wildlife on proposed river basin developments. Notwithstanding, certain forest wildlife projects have been carried forward.

For example, an 8-year study of browsing pressure as indicated by clipping on white cedar was completed this year at the Upper Peninsula Experimental Forest. A similar clipping study on hardwood browse species was completed on the Superior National Forest. A 4-year clipping study to simulate rabbit injury to plantation stock was completed on the Nicolet National Forest.

The effects of DDT on wildlife was studied in conjunction with the spraying of jack pine plantations on the Nicolet National Forest. No serious losses of wildlife were encountered, as the applications were light and on too small a scale to be properly appraised.

An airplane count of moose on Isle Royale National Park and a subsequent browse survey will supply valuable information on management that can be applied to other forested areas.

Repellent paints of various combinations have been supplied to the Chequamegon, Nicolet and Upper Michigan National Forests for applying to buildings in the woods where porcupine damage is being encountered. These tests will help to determine the most effective means of reducing porcupine damage.

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